THINGS THAT ARE USUALLY WRONG

THINGS THAT ARE USUALLY WRONG

BY JOHN E. SWEET

New York
Hill Publishing Company
1906

PREFACE.

The following is in the main a reprint of a series of articles published in the *American Machinist*, and it is thought by the author and publishers that it will be found useful to Mechanical Engineering Students, Machine Designers and Inventors; and should those who buy the book be disappointed they can console themselves with the fact that it did not cost much.

It will not be strange if, among so many statements, some are unjustifiable; but those who hunt them out will profit more by it than those who accept all as fixed facts.

The book is small and it is the hope of the author that the most of the readers will wish there was more of it.

JOHN E. SWEET.

Syracuse, N. Y.,
May 1, 1906.

THINGS THAT ARE USUALLY WRONG.

INTRODUCTION

Whoever designs a new machine or an improvement on an old one conceives of some feature or ruling object of his design or some feature that is an improvement on present practice and neglects the other features—simply follows common practice without considering whether the other features may not be as open to improvement as the special feature he is working out. As an example, the designer of a new lathe for high-speed steel or the electric drive invents a new headstock, puts more iron in the bed, sticks under it the old supports, puts on the old tailstock, uses the old slide-rest and the compound rest, without a thought as to whether there are any better ways. The writer knows how this is done because he has done the trick himself over and over again, and the object of these comments on the things that are usually wrong is to stimulate designers to avoid them.

An old machine company, thinking they would go into the high-speed, high-class, shaft-governed steam-engine business, employed a draftsman or mechanical engineer who had some original idea as to a shaft governor. He followed precedent in all things except the governor, and made his drawing of the cylinder.

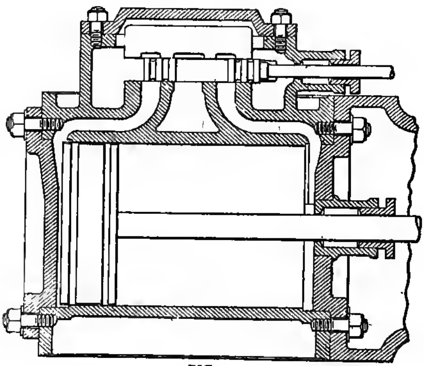


FIG. 1

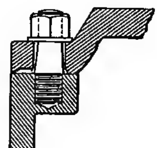
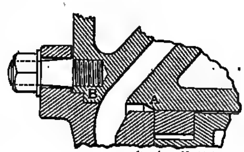


FIG. 2



American Machinist

FIG. 3

He had found that in order to get in his valve motion the valve needed to be a considerable distance from the cylinder, otherwise there was no special requirement, and Fig. 1 shows how he made it. It looks so much like common practice as not to attract particular attention, and yet there are

half a dozen things about it that are far from being as good as they might be or as they ought to be, to be called twentieth century high-class steam-engineering practice.

First, the studs go through into the steam chest, which is all wrong, to avoid which calls for the cylinders being an inch or two longer, and besides, if the best is wanted, the ends of the studs that tap into the cylinder should be one size larger than the outer ends, as in Fig. 2. When a stud of this kind is broken off, it can be removed without drilling out the piece in the casting. It is sure to part outside the cover, as the weakest point is at the bottom of the thread under the nut, rather than at the bottom of the thread where it goes into the casting, and is one size larger.

As the valve is a balanced valve, there is no objection to making it as long as possible, so as to reduce the length of the steam passages as shown in Fig. 5. The steam passages are shortened still more by making them straight, and this reduces clearance and makes them easy to clean.

The counterbore should end as at *A*, Fig. 3, so that the piston may be pushed into the cylinder without the rings having to be held in by some extra device. Some of the

engine builders who aspire to the Corliss type still persist in leaving a square shoulder. The joint between the cylinder and cylinder head is too wide and is better protected if as at *B*, Fig. 3; besides, by this plan the condensing surface in the cylinder is reduced. The joint between the steam-chest cover and steam chest is too wide also, and should be as close to the bolts as practicable, as in Fig. 2; the flange of the cover needs to be thick so as not to spring between the bolts. If the joint is only about one-quarter of an inch broad and well machined, there is no occasion to scrape, grind, nor pack the joint. Simple truly machined surfaces, bolted up, will be steam tight.

There is no necessity for two passages through each end of the valve, and the ledges or shields in the exhaust opening in the valve are a necessity to prevent the exhaust steam from cutting away the cover-plate bridges. These two passages through each end of the valve show two things—the persistency of habit and that the copyist copies the bad things with the good. For some reason, the writer does not remember what, two through passages were put in the early engines, and for just no reason at all the practice was contin-

ued for years in all sizes of engines, and about all the copyists put in the two passages also without taking the trouble to question why.

The plug in the frame for the stuffing box, if driven through from the inside, as shown in Fig. 5, avoids cutting the thread and proves to be in practice all that can be desired. By calking in the plate in the exhaust chamber as at *C*, Figs. 4 and 5, the exhaust can be

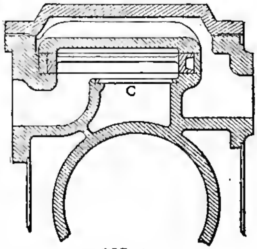


FIG. 4.

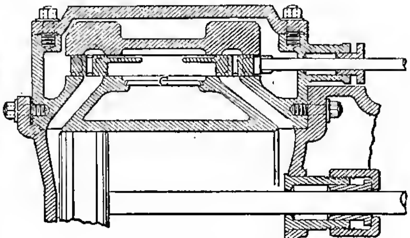


FIG. 5

American Machinist.

completely cut off from the cylinder wall, thus reducing cylinder condensation.

EQUAL LENGTH WEARING SURFACES.

Something over thirty years ago, in a series of articles in *Engineering*, the writer advocated to a considerable extent the advantage of equal-length wearing surfaces, and being at that time in a position to put his ideas in practice, had built, among other

things, a milling machine in which both the knee on the column and the horizontal slide had equal-length wearing surfaces. The machine has been in use ever since and neither slide has worn enough to need taking up, much less refitting. A punching machine was built in which the slide was a mechanical fit without any provision for taking up wear. The last time the writer saw it it was in perfect condition. The cross-slide of the lathe built in 1882, illustrated in the *American Machinist* in 1889, has never had the slack taken out of it.

The first Straight Line engine, built in 1872, had crosshead and guides of equal length, and when worn out both were as truly straight as when made. Ever since those days the writer has been preaching right and doing both right and wrong—right when he had the courage, and wrong when he was silly or too much of a coward.

Two or three years ago the writer put in words what he believes to be a fact, that "Things that do not tend to wear out of true do not wear much." The cases enumerated above go to confirm this on the one hand, and recently we had occasion to confirm it on the other. Mr. Porter, in his

"Reminiscences," tells of running crossheads for years without wearing out the scraper marks.

We have been building engines of the slipper-guide sort with the crosshead shoe equal to the length of the stroke and the guides considerably longer—that is, about half way between what other engine builders would make them and the length of the stroke. These surfaces were always scraped to surface plates much larger and as true as Mr. Porter could get his made, probably, and we never could get any such result as he claimed. The scraper marks would always soon disappear in the middle of the guide, and this to any observant man ought to have been enough to convince him that the guide was too long. We understand that it is better to make the sliding piece longer, but won't do it because it costs more money, and we won't cut off the guide and save money, because why? There is another element entering into this slipper-guide crosshead proposition, and it may be well in this connection to explain it. Fig. 6 shows the crosshead and guide. The crosshead, it will be understood, overruns the guide half of its length at each end, and if on a slow-speed engine no doubt the

guide would wear off the most at the ends, but in the case of the high-speed engine, inertia and momentum change the conditions.

It will be seen that the center of gravity of the crosshead is below the center line of piston rod and connecting rod. When the piston is at the end of the stroke as shown, and starts back, the inertia of the crosshead tends to rotate it around the crosshead pin

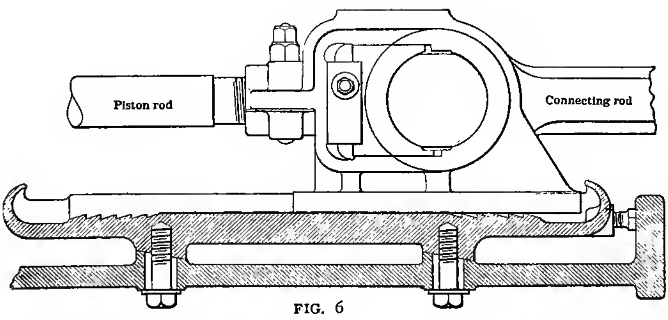


FIG. 6

and so tends to wear out the middle of the guide, and at the end of the stroke being resisted by the connecting rod tends to do the same thing, so that while gravity would tend to wear off the ends, inertia and momentum tend to wear out the middle, one balances the other, and now we have a cheaper guide and one that shows no evidence of wear what-

ever. This cutting off of the guide led to trouble in another way. It has always been the aim to hold the escaping oil at such a height that it would be drawn on to the guide by the crosshead, but with the short guide the crosshead would strike it while going at its highest velocity and splash it all over the engine-room. The ratchet surface suggested by Mr. E. J. Armstrong not only prevents this but to a much greater extent than when the guide was full length.

This world is too large and time has been too long for one to be safe in saying anything is new, but certainly this treatment of the subject is not common and it is right.

The crosshead and guide are not the only things in steam-engine practice that are usually wrong. The valve-rod guide in the regular run of slide-valve engines is as bad as it well can be. Fig. 7 shows a common form and Fig. 8 the same thing without much change except in locating the guides farther apart, and cutting off the wearing surfaces so as to make them of equal length. It will be seen by the dotted line that the three centers are in line. The writer is not foolish enough to think that the old engine builder who is making his valve-rod slides

like Fig. 7 is going to change them to be like Fig. 8, nor is he sure that he can convince the old men that the old way is all wrong and the new one right, but it is true and he believes the rightly trained college man will believe him.

Forty or fifty vacuum engines made this way, which have been running twelve or

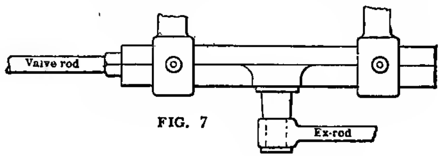


FIG. 7

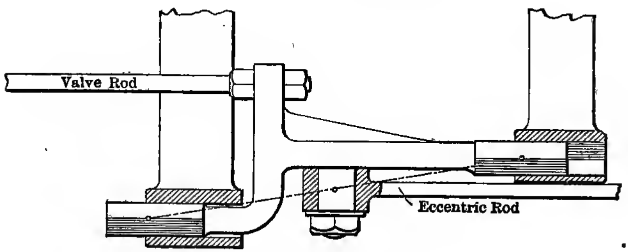


FIG. 8.

fifteen years and show absolutely no wear, prove it. If they do wear, the slack can be taken up without redressing the wearing surfaces, whereas in the original form they are sure to be loose in the middle of the stroke and tight at the ends.

The form shown in Fig. 7 is wrong in another respect. The eccentric rod tends to swing each end of the slide back and forth at every stroke, which cannot be avoided in any way, but owing to the angularity of the eccentric rod it tends to rotate the square bar in its guides at every stroke, which is far worse than the side pull. By the central pull shown in Fig. 8 that is avoided.

Ninety-nine out of a hundred are going to say, "See what it costs!" The writer is not arguing the cost, but the right and wrong. The principle may come in play in many places beside the valve-rod slide of a common engine.

OVERHUNG CRANKS.

The common form or way of putting on overhung cranks is not the best. Mr. Charles T. Porter in his first engines reduced the overhang to its lowest safe limit and maintained that point ever after. To illustrate the the idea Figs. 9 and 10 show the difference between common practice and Mr. Porter's idea, or just the difference between right and wrong.

In the case of a Corliss or other engine of the side-frame sort, this reduction of the

overhang, besides reducing the twisting, reduces the tendency to swing the cylinder from side to side, or to spring the frame. Although the overhang of the crank works on the short end of the lever, the pull and push of the piston are so great that the swinging tendency is considerable, and a few

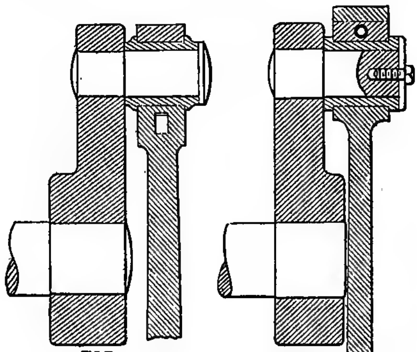


FIG. 9 FIG. 10

American Machinist

inches reduction in the short lever makes a large difference.

CORLISS ENGINE FRAMES.

As the Corliss frame is usually made, Fig. 11, it can be easily seen that there is a tendency to buckle the frame, and the greater the overhang the greater the tendency. Why

the frames are not made straight, as shown by dotted lines and by the elevation, Fig. 12, is likely because Mr. Corliss did not make them that way, and possibly they are not made that way now because the builders never thought about it, or would not like the looks, or feared customers would not buy them. By making the rear half, box section, as indicated, there would be no call for a support under the end of the guides, the

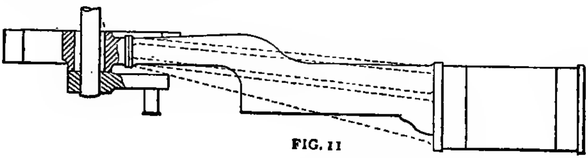


FIG. 11

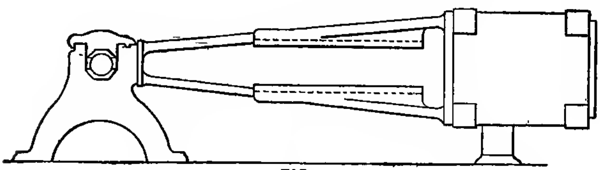


FIG. 12

builder would be spared the humiliation of depending on the mason for an engine frame, and, with a single support under the cylinder, the whole thing would become self-contained. The cylinder should be free to expand horizontally, but so secured as to prevent the side-swinging of that end of the engine.

CORLISS ENGINE CYLINDERS.

Experiments made in England by boring a Corliss engine cylinder with steam on and then testing it cold showed great distortion, due to the steam passage joining the walls of the cylinder. Watts and Campbell satisfied themselves that the exhaust passage next the cylinder was a bad thing and adopted the plan of making it an independent passage, so it is probable that the usual Corliss engine practice, in which the passages are not separated or the cylinders bushed, is really bad.

ROCKER ARMS.

Arranging to compensate for the offset between eccentric and valve rod in the case of shaft-governed engines by using a rocker is a thing that it is easy to get wrong and not so very easy to get as near right as one would wish. Of the common kind shown in Fig. 13, the tendency is to rotate back and forth around a vertical center and wear out the hole at each side at both ends and wear off the shaft in like manner. Fixing the rocker to a shaft as in Fig. 14 is better, as it not only throws the bearings farther apart but the bearings are better lubricated where the oil can be introduced on the slack side. Such

rocker arms are best when cast of hollow box section, as that form is better to resist torsion.

Where a form such as shown in Fig. 15 can be used, it is a great improvement if a line drawn from the center of one wrist to the center of the other passes centrally through the main bearing. The form shown in Fig. 16 is better still, for the reason that Fig. 14 is better than 13.

The same principle is embodied in the form shown in Fig. 17, which, however, re-

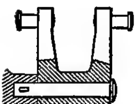


FIG. 13

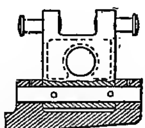


FIG. 14

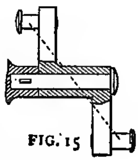


FIG. 15

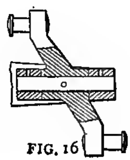


FIG. 16

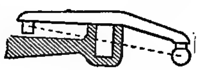


FIG. 17

quires ball connections for the eccentric rod, although it requires much less of a projection for the supporting bracket.

STEAM CHEST COVERS.

The common way of locating the studs for securing steam-chest covers is to put one on each corner and space the others between.

The corner is the wrong place, but the two studs, next each corner should be so located that a line from one to the other will pass inside the corner of the packing strip, as in Fig. 18.

SLIDE VALVES.

It is fairly common practice in the case of the common slide-valve engine to make the valve seat so long that the valve will overrun but a short distance, and in some cases

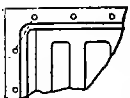


FIG. 18

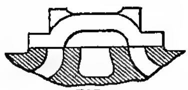


FIG. 19

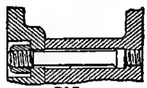


FIG. 20

American Machinist

the valve will not overrun at all. This is bad practice, as the seat always wears concave. If it is designed to have the valve cut off at three-quarter stroke, the lap of the valve will be one-quarter the travel. If the ports and bridges are also one-quarter the travel, then by cutting away the valve face so it is only as long as the valve, as shown in Fig. 19, there will be the same wearing surface on the seat as the valve, and the two will remain straight and keep tight, if they do not cut out by the steam, much longer than if made the other way.

ENGINE PISTONS.

One conversant with engine repairs needs only to call to mind the number of accidents he remembers that have been caused by cap-screws used to hold the followers on pistons that have worked loose, to admit that that is a poor way to fasten on followers.

Bolted through as shown in Fig. 20, with the body of the bolt turned down to the bottom of the thread and secured by Tobin bronze nuts is better, and they will never come loose.

STEAM PORTS.

To file out the corners of the ports square and true is common practice, to leave them round-cornered—that is, with fillets in the corners—is better. Worn seats show a prominent streak in line with the end of the port, which is avoided where the corners are left round.

PLANING MACHINE WAYS.

It would be interesting to know how it came about that planing machines were from the start made about right. If the proposition were a new one and given to an engine builder to design, likely the bed would be made so near twice the length of table that

the table at full stroke would overrun only two or three inches at most at each end. Whether the original builder figured out what was about right or found that the long bed would cost too much, or what, is a question. That he got it right is plain enough, and it seems to be the one standard thing in the way of sliding surfaces that became right originally, and proves that men follow precedent just as plainly in the things that are right as in those that are wrong.

MILLING MACHINES OF THE PLANER TYPE.

In the substitution of milling machines of the class that corresponds with planing machines, we all followed blind precedent, while the conditions are quite different, and the writer very much doubts if the bed of a milling machine of the kind in which a barrel mill puts an intense pressure at the cutting point needs to be much if any longer than the table. When gravity tends to wear off the ends of the bed and wear out the middle of the table, this downward pressure of the cutter tends to produce exactly the reverse result, and they will come very near balancing each other.

In designing a machine of this kind except with a vertical spindle, with which the downward pressure is much less, we made the mistake of copying planing-machine practice, and as a result found within a month or two that the scraper marks were disappearing in the middle, and set a machinist at work cutting the surfaces down to make the bed only half again longer than the table. With these proportions the guiding surfaces will remain straight as long as the machine lasts.

In this class of machines, particularly where a vertical spindle is used, as in the traversing machine, a grave mistake is made and money wasted in making the side guide as long as the ways that carry the load. As shown above regarding the ways that carry the load, gravity works one way and the pressure of the tool the other; but in the case of the side guides it is wholly tool pressure to be provided for, and the guiding way should be only about three-quarters as long as the wearing surface on the table, and thus about one-half of the side guiding surface can be cut away and the planing and scraping of that much be saved.

In dealing with this traversing-machine question, the persistence of habit showed itself in another way. In the case of a planing

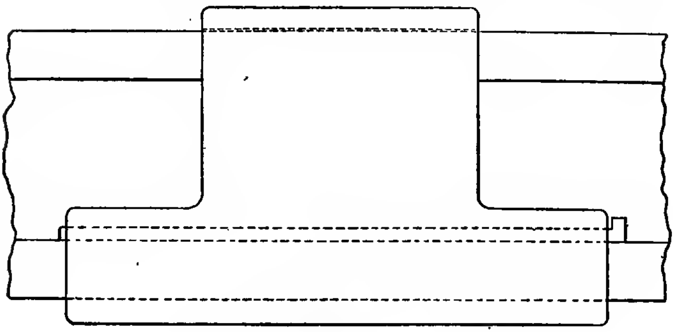


FIG. 21

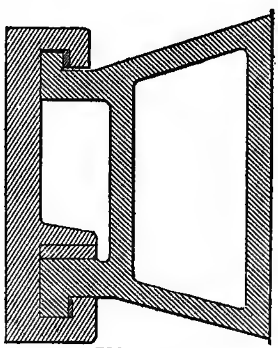


FIG. 22

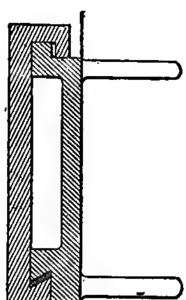


FIG. 23

machine in which the head is guided by the cross-rail, it never has to move while the cutting is taking place, and hence its tendency

to wear is very slight; whereas, in the case of the vertical-spindle machine, it moves under strain, and the guiding element ought to be nearly as efficient as that of the table itself. In the original traversing machine very little attention was paid to this, and as a result the central wear showed itself promptly, and only by cutting away the ends of the guide was it made fairly practical.

In a second machine, built by the Pratt & Whitney Company, the guiding part was made twice as long and the guiding was done wholly by the lower part of the crossrail, as shown in Figs. 21 and 22, the guide at the top serving only to keep the spindle vertical. The difference between the two is the difference between just wrong and as nearly right as it well can be.

This feature of the traversing machine is the same as on profiling machines, which have always been wrong. The whole of the guiding should be done by the lower portion of the cross-rail, as near the work and driving power as possible, a principle that holds good in all slides. The section shown in Fig. 23 is not an uncommon and a ridiculously frail one where it bolts to the housings.

There has always been diverse practice and, from time to time, much discussion about the guiding of the slide-rests of lathes. The V has the merit of remaining free from lost motion, however much worn, but nothing is much more ridiculous than two V's, as the one at the back does no good and costs money. The common flat way is bad because the guiding surfaces are too far apart. The plan

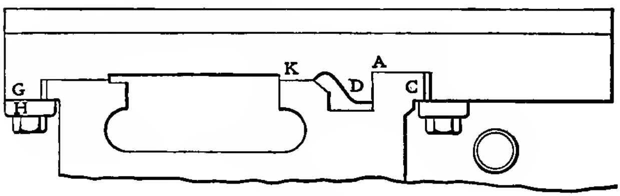


FIG. 23 A.

adopted by John Lang & Sons, Fig. 23 A, is much better. The guiding though by flat surfaces, is at the front where it ought to be, and when all the metal and work is concentrated on the one guide it can be twice as long and four times as efficient.

SHAPING MACHINES.

There are certain things about shaping machines that were made in certain ways by

the inventor Nasmyth, which ways have been followed by every manufacturer from his day until the present time. One of these things is the location of the guiding slides of the ram, which are, in the main, as shown by Fig. 24. So far as the guiding feature is concerned, that location is as proper as any, but there is another feature and that is the "cocking" or setting over of the tool-holder

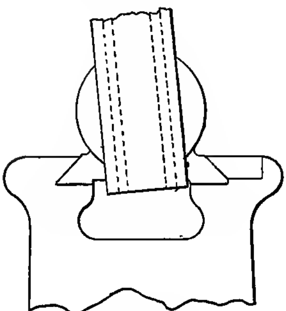


FIG. 24

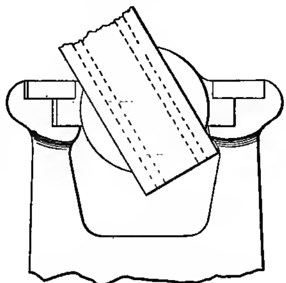


FIG. 25

slide for planing at an angle, when, if turned to a slight angle, the tool-holder slide collides with the guides. If the guiding element were placed as shown in Fig. 25 a cut at a much greater angle could be made and yet have the tool-holder slide clear and this without impairing the guiding feature.

The guiding surfaces of the ram and guides are sure to wear most at the front end.

The remedy or partial remedy is to cut away the wearing surfaces at the rear, cutting away more and more as the rear end is approached. Fig. 26 shows a good and simple way to lay out the lands by striking the diagonal *A B* and taking the distance below the line for the width of the lands and the distance above for the gaps. Making the cuts diagonal in one direction in the slide and in the opposite direction in the guide will insure even wear. This will cost work, but the machine that never needs correcting never

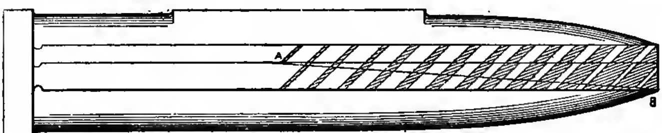


FIG. 26

works badly, while the one that has to be overhauled every few years gets too bad to use before it gets refitted.

The ordinary method of making the vertical slide of the knee on the post of the single-post shaper has the objection that all the sliding surfaces are exposed to the accumulation of dirt and sand from the work and the guiding surfaces are an unnecessary distance below the cutting tool. When the knee is not used as a moving slide for the

feed, but is slacked off when raised vertical and lowered and made fast for use, the dirt is liable to accumulate in the joint—in fact, this is practically unavoidable and bad, and when the knee is used for the vertical feed it will, if the surfaces are of equal length, and made as shown in Fig. 27, maintain its fit so perfectly as to require no loosening or binding, and the guiding surfaces can be extended up as high as the top of the vise, as shown in Fig. 28, and thus bring the cutting strain directly against a surface at right angles with

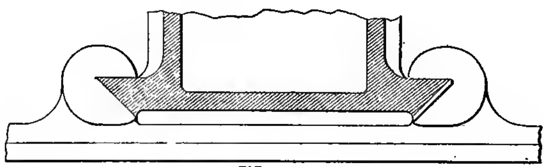


FIG. 27

the push. To get the wearing surface at right angles with the push, which is right, the lever in the case of a crank planer should have the wearing surface where the main work is done, on the central line, as shown in Fig. 29. To demonstrate that this is right, a good way in this, as in most mechanical problems, is to carry the wrong way to an extreme and note the consequences, and it

will be found that the right way has already

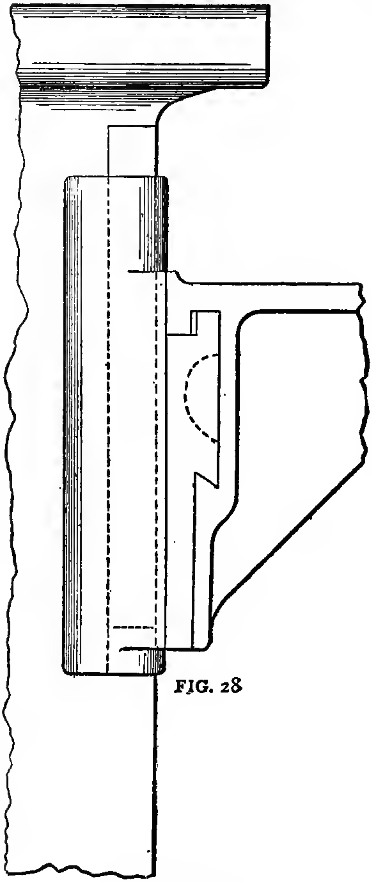


FIG. 28

American Machinist

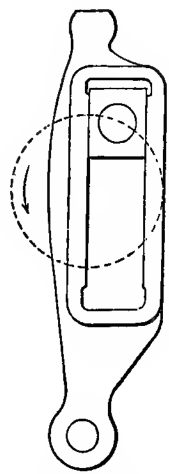


FIG. 29

American Machinist

been carried to the extreme in the right direction.

If one were to try and find the worst place to part the rim of a split pulley, so far as resisting centrifugal force is concerned, he would find it just where they are usually parted—half way between the arms. There is in this case not only the additional weight of lugs and bolts, adding to the centrifugal force, but the grip of the bolts which, when made as usual, Fig. 30, tend to throw out the rim at this point. If parted as in Figs. 31 and 32 and the joint is made as strong as the rim in other parts, the split pulley will, except for the weight of lugs and bolts, stand the same speed as a solid one. There is a third strain seldom considered—the pull of a heavy belt which tends to bend in the rim between the arms on those sections where the belt laps the pulley, as at *A B C*, Fig. 33—an action which tends to throw out that part of the rim where there is no belt, as at *D*, so that in addition to the weight of the lugs and bolts and the strain of the bolts, there is this third strain, which may be the greatest of the three. With the joint through the center of the arm, weakness, so far as the parting is concerned, is pretty well avoided.

In some cases there was at the start a

reason that justified making things in a certain way, which, later, did not obtain, and yet the old way was continued, many times because the old patterns continued in use, but more often because of the habit of doing things as they had been done before. A fair example of this is shown in Fig. 33. Why the joints in the early split pulley hubs were made in this way, may have been because that was

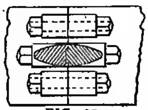


FIG. 32

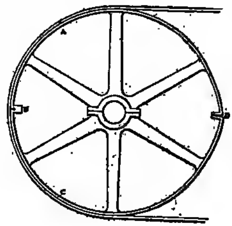


FIG. 33

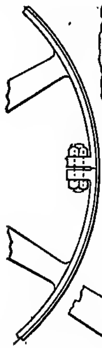


FIG. 30

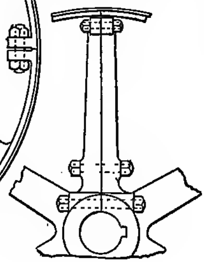


FIG. 31

FIG. 34

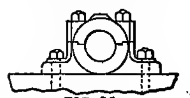


FIG. 35

the way parted boxes were made to bolt to wood framing, Fig. 34, or it may have been that the bolts were the costly part of the job, and the thin flanges called for short bolts, or it may have been a cheap way to make the pattern. Anyway this form of securing the two parts of boxes and pulleys died hard,

with good examples, as shown in Fig. 35, in sight. The wrong sort stayed by the New England mechanics long after the right was common in Philadelphia. And it was the same with the tailstock of the lathe. It seems as if the most of the New England builders never would have given up the original tailstock, which had everything possible wrong about it, if it had not been for the foreign demand, forcing them to change to the better way.

LATHE TAILSTOCKS.

Perhaps none like to learn, or improve, at least, but one thing at once. Our lathe-builders have learned to improve the tail stocks of their lathes by cutting away the front so as to give the compound rest a show, but resist projecting the nose so as to have it reach out over half the width of the cross slide as it should to support the tail spindle. The Champion of the present practice comes back with the reply that that shortens the length of the piece that can be turned just so much, and that is true enough. But is it best to endure a bad thing three hundred and eleven days in a year for the sake of having it do what we want it to the three hundred and twelfth, remembering

that there is always something to turn that is too long for the lathe.

TIGHT AND LOOSE PULLEYS.

There are at least three wrong ways and one right one to arrange tight and loose countershaft pulleys: Fig. 36 is right, Fig. 37 is bad and very common, Fig. 38 worse, and

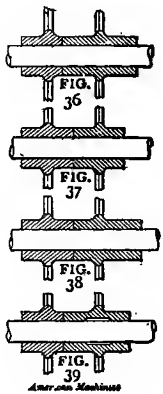


Fig. 39 worse yet, if possible. Too little wearing surface in one, the next is sure to wear the hole bell muzzle and the shaft tapering, and oil gums up in the chamber of the last and absorbs the next charge of oil, so that none gets to the bearings. A chambered pulley or gear of any sort is worse than a

good continuous fit. There is never too much bearing surface for any wheel that needs to be put on to stay or to run on a journal.

PLUGGING HOLES.

Where cored or other holes in castings are to be filled it is the common practice, pretty nearly the world over, to tap out the hole with a gas or other taper tap and plug it with a gas or other threaded plug. This is neither the cheapest nor the best way. If the hole is to be plugged for looks only, drill out the hole, turn a plug to fit and drive it in; if subject to steam or water pressure, ream the hole, turn the plug to fit and drive it in.

If not larger than two or three inches and driven with a machinist's hand hammer, nothing less than a hydraulic press or freezing water will force them out by direct pressure. Such plugs can be turned or planed off without unscrewing by the tool; the streak left by the thread when they are threaded in is avoided, and aside from the difference in the iron, they will not show. In the case of water-jacketed gas engines, freezing water may force them out and avoid a cracked jacket. The trouble with this scheme is to

get mechanics to understand how much above any ordinary pressure it requires to force out a plug put in in this way.

SAFETY PLUGS IN PISTONS.

Plugs $2\frac{1}{4}$ inches in diameter, $\frac{3}{8}$ inch thick, tapering $\frac{5}{8}$ inch to the foot, put in by hand and driven $\frac{1}{16}$ inch, cannot be forced out by 200 pounds pressure to the square inch, and a light blow with a machinist's hammer drives them that far. These are the relief plugs in the pistons of the Straight-Line engines, and are made to be forced out by water in the cylinder. Those put in to stay should be parallel fits, as should everything else that is to be put in to stay.

NAILS AND FILE TANGS.

A common tapering cut nail when compared with a pointed parallel wire nail is bad enough, but of all ridiculous things is the tang of a file made to be burned in the pith of a round stick, and its shape persists just as if auger bits and twist drills, which make straight parallel holes, had never been invented.

UPSETTING A RIVET AT THE BOTTOM OF A HOLE.

Where two pieces of metal are to be fastened with no room for bolt heads and nuts, screw rivets are usually employed. Pieces of wire or rods are put through the outside piece, threaded into the other, cut off and riveted. A plain parallel drive fit in

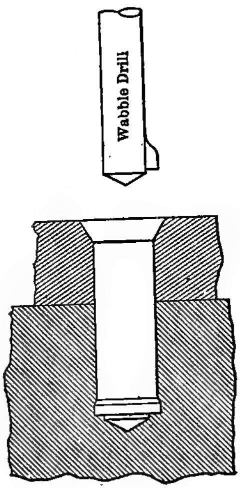


FIG. 41.

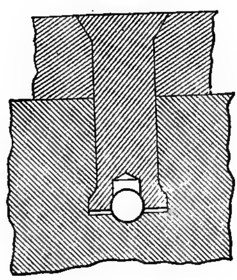


FIG. 42.

the lower piece is better than the thread, will hold more than it will take to break the other at the bottom of the thread, and it will never work loose. If something more secure is wanted, the rivet can be easily headed

in the bottom of the hole. A very simple wabble drill will chamber the bottom of the hole, and if then the hole is drilled a little deeper with a smaller drill and the wire well driven, it will upset at the bottom, as shown in Fig. 41; or if the end is drilled and a ball set in, as shown in Fig. 42, it will upset also. This method is in use by the Link-Belt Engineering Company.

UNFASTENED FALSE VALVE SEATS.

Years ago it was not an uncommon thing to put on false seats for the slide valves of locomotives. It was common practice to use screw rivets to secure them, and Henry Watkeys, master mechanic of the New York Central & Hudson River Railroad, proved himself a genius when he abandoned the use of all fastenings. He simply cast horns to fit inside the chest to hold the false seats in place and rightly assumed that the steam pressure that would hold the valve to its seat would hold the false face to its seat also. Knowing of this experience, it took no genius at all to conclude that a direct-connected engine and dynamo fitted to one complete base needed no bolting down to the foundation.

STEEL SMOKESTACK CONSTRUCTION.

In the construction of iron or steel smokestacks the common practice of shingling the second section over the outside of the first, and so on, putting the bottom of one section outside the one below, is all wrong where the stack is not brick-lined. The rain goes inside the stack as well as out, and that inside takes up the sulphuric acid from the soot and washes it into the joints between the sheets and rusts them out. Often this rust can be seen streaking down the outside. If the sheets are put together the other way, the upper sheet inside the lower, the acid does not get into the joint, and if water gets in it is fresh water; besides the joint can be calked or filled with putty and paint.

The objection is that the stack does not look as well, which may be because it is different from what we are used to seeing; but it opens up the way to make it look far better by following this plan: Make every section parallel, each section twice the thickness of the metal smaller than the one below. This will taper the stack from four inches to a foot, perhaps, according to hight, thickness of iron, etc., and if made part of this differ-

ence larger at the bottom and some smaller at the top there will be the same capacity and greater strength with a great improvement in looks. A properly designed cap will improve the draft and the looks, and there is no more reason why a stack should

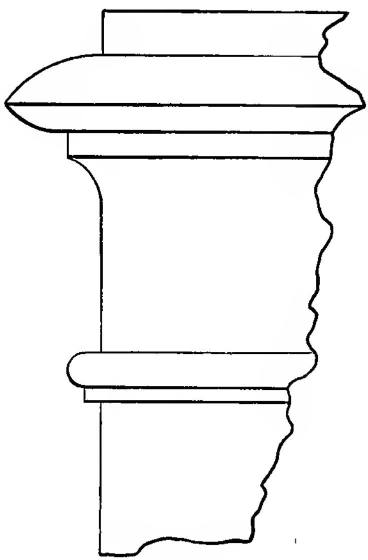


FIG. 43.

not look well than a building or a column. Fig. 43 shows as good a one as I have seen. It is simple, has practically the right slope at the top to insure what improvement is to be

had in the draft, and comes so near good looks that nothing can be left off for its betterment.

LATHE AND SUPPORTS.

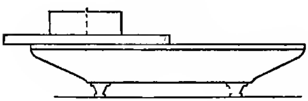
No reasoning can make it out that the place for the support of an ordinary sized lathe bed at the tailstock end of the lathe is at the end. If placed a considerable distance from the end, and the tailstock is at the end, it is better supported than when in the middle of the present style of lathes and also better supported at all other points. At the headstock end it is quite a different matter, as the headstock is always fixed and is usually heavier loaded, exclusive of its own greater weight. Where the headstock end support is a closet, there is no way to make it look right except to have the closet the same width as the headstock is long.

PLANING MACHINE BEDS AND SUPPORTS.

In the case of a planing machine bed up to twelve or fifteen feet in length there is no reason for having three pairs of supports. Unless the foundation is absolutely unyielding—a thing that is more rare than the other kind—the three or more pairs of supports

are especially bad, and to attempt to hold the foundation true with a frail planer bed is foolish. The distance between the supports in Fig. 44 is no greater than in 45, as in no case, would the center of the load in planing overhang the supports more than a slight distance; the style 44 is quite as well supported as the other, and when the iron in the legs and the work to fit them are taken into account, if they were all put into the casting the bed could be brought down to the floor as in Fig. 46, greatly improving the structure.

FIG. 44.



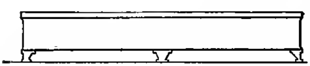


FIG. 45.

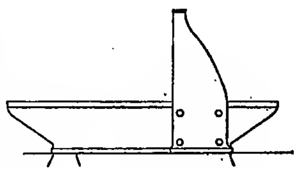


FIG. 46.

Another improvement is to use the iron usually put in the cross girts—which do not stiffen the bed in any way to any great extent—and use it in bottom and top webs, making the thing a four-sided box, which is from four to a dozen times stiffer in all directions, and then rest the whole thing on three points, one under the back of each

housing and one under the middle toward the other end. The whole thing, including patterns and setting, will cost no (or very little) more and be four times better than present practice.

If the bed is supported at the same points when it is planed and fitted up, no attention or skill is required in the erection—just set it anywhere and on anything solid, and that is all that need be, or can be done.

OILING PLANER WAYS.

The modern method of oiling planing machine ways is small rollers or wheels in oil pockets; a great improvement would be to use deep pockets and wheels six inches or a foot in diameter, and then to pipe the oil from the end pockets to the bottom of the roller pockets and thus make the oiling continuous.

THE ANVIL PRINCIPLE IN LATHES.

If there is any other place where it is as easy to fool away money as to put on a coreprint and make a core box to take iron out of a lathe headstock, the writer does not at this time think where it is. If there is any place, except under a forge hammer,

where the anvil element needs to exist more than in a lathe headstock, it will be hard to find it.

When cast-iron flanges are bolted together the usual form is about like Fig. 47, with the chances that the casting have

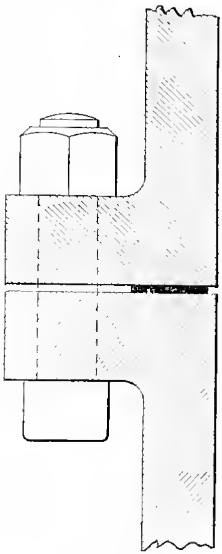


FIG. 47.

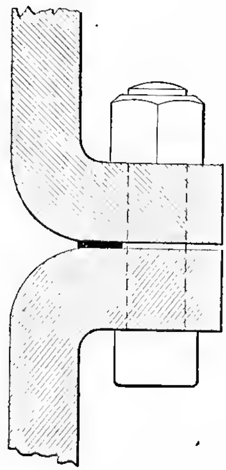


FIG. 48.

shrinkage holes in some part of it and a crack at the angle, whereas if made as in Fig. 48 there will be a saving of iron, less likelihood of shrinkage holes, no crack in the angle and the packing strip will be

brought close to the bolts as it ought to be. It will cost extra for one core-box and save iron in all castings besides making a better job.

Fig. 49 shows an old style of machine framing and one not infrequently used at the present time. The pattern is frail and costly to make, the casting is an expensive one in the foundry, difficult to clean and

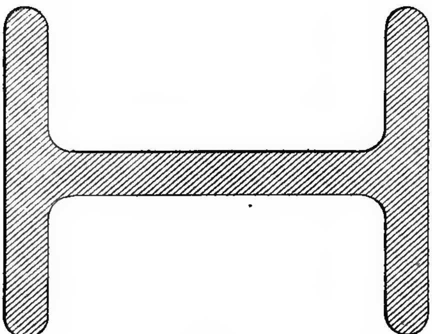


FIG. 49.

MACHINE FRAMING.

keep clean, and weak so far as resisting torsional strains. The rectangular round corner cored section is better in every way.

FACE PLATES OF LATHES.

One of the silly things to do is to build a machine costing several hundreds of dol-

lars and rob it of a great part of its usefulness to save a few cents or dollars, or to rob it of its efficiency to save the operator a little work. Just why an eighteen-inch or a twenty-four-inch or a thirty-six-inch lathe should have a sixteen-inch, twenty-inch or thirty-inch face plate only, when one full size of the swing would always do as well, and many times a long ways better, is hard to find out, and yet such is the universal practise. Of course it is as good as the other fellow furnishes and its cheaper. Why should a face plate be a frail affair? It's cheaper, and easy for the workman to lift, and almost worthless when in use. The absolute value of one made in box section with as many slots in as possible and the full swing of the lathe is so infinitely superior after one trial that all others seem a nuisance.

COMPOUND RESTS.

If there is anything about a lathe which more than another builders keep making wrong without reason it is the American compound rest, which the user has to set parallel with the cross-feed slide to use in common practice. As made it brings the

screw handles just where they cause the most bother to the operator, gives him two ways to do one thing where one is enough and robs him of one motion that he would frequently use if he had it. And it all comes from following habit, without reason. The compound rest can be set at any angle, but it never is set in any way except parallel with

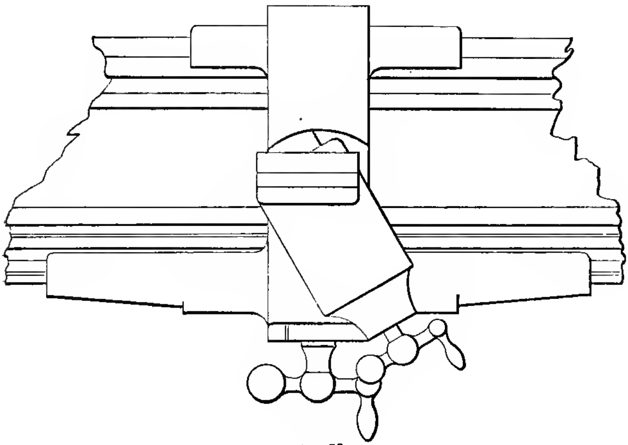


FIG. 50.

the cross-slide because the workman wants the tool-post slot parallel with his work. The remedy, or, to put it stronger, the right way is to put the tool-post slot, as illustrated in Fig. 50, at an angle of thirty degrees from the usual position. The workman still sets

his slide so the slot is parallel with the work, which brings the handles away from each other, enabling him to feed up his tool for a facing cut without disturbing the main slide, to get his tool-post inside the chuck jaws and to take the cut in cutting V-threads all on one side, which reduces the time of thread cutting about one-third.

One builder is prepared to furnish one of these for his thirty-inch lathe at the same cost; in fact, any lathe builder can furnish one at the same cost except for the cost of the extra pattern, and yet they will not until someone orders them, and it will be twenty years before anyone will do that. It was fully twenty years or more after the ring oiler was illustrated and described before anyone else took it up, and then only after Mr. Edison had set the example.

And now as I close the question arises, Is any good to come from this tirade about things that seem to me to be wrong? It's easier to tell others what to do than to do it yourself. One who cannot reconcile him-

self to the spelling (tough) tuf, (thought) thot, and (straight) strat need not expect the other old fellows are going to change their patterns, or practice, even should they be convinced that they are wrong, and it is only those who come to think of the best way who are likely to do the best; and those also who think that the "best way is bad enough."

INDEX.

Balance valves 7, 8, 20
Boxes on wood framing 32

Counterbore 7
Crosshead 11
Cranks 15, 16
Correcting for unequal wear 11, 12, 28
Crank planer 26, 27, 28, 29
Corliss engine frames 16
Corliss engine cylinders 17
Cast iron flanges 44
Compound rest 46, 47
Conclusion 48, 49
Clearance 7
Cross girts 42
Cross rails 24, 25

Exhaust jacket 9–15
Equal length wearing surfaces 9, 20, 22–30

Following old practice . . . . . About every page in the book
Followers 21
False valve seat 38
Face plate of lathes 45

Location of wearing surfaces 27, 28, 29
Lathe tailstocks 33
Lathe-bed supports 41
Lathe headstocks 43
Lathe slide rests 26

Making plans for new engine 6
Milling machines 22
Machine framing 45
Machine cross rails 24, 25

Nails and file tangs 36

Oiling devices 13, 43

Planing machines 21, 41, 42
Plugging holes 35, 36
Pipe flanges 44
Preface iii

Rocker arms 18, 19

Safety plugs in pistons 36
Studs 7, 19
Steam passages 7, 8
Steam chest cover 8, 20
Steam joints 8, 9
Scraped surfaces, index of wear 11, 12, 23
Slipper guide 11, 12
Slide valves 20
Steam ports 21
Shaping machine 26, 27, 28, 29
Shaper and milling machine knees 28, 29
Split pulleys 31, 32
Slide rests of lathes 26
Smokestack construction 39, 40

Tailstocks of lathes 33
Tight and loose pulleys 34
Traversing machine 33

Upsetting a rivet in a hole 37

Valve-rod guide 13, 14
Vertical Slides 28, 29, 30

Wearing surfaces at right angles with push . . . 29